

Revision of the European Marine Forms of the *Cirolaninæ*, a Subfamily of Crustacea Isopoda. By H. J. HANSEN, Ph.D., F.M.L.S.

[Read 2nd February, 1905.]

(PLATES 33-35.)

IN 1890 I published a paper entitled "*Cirolanidæ et familiæ nonnullæ propinquæ Musei Hauniensis*" (K. Danske Vidensk. Selsk. Skrifter, 6. Række, naturv. og mathem. Afdeling, B. v. pp. 239-426, tab. 1-10). The material preserved in the Copenhagen Museum was comparatively rich; from Europe and the West Indies especially it possessed a large number of species. I was therefore able to prepare the treatise as a kind of monograph: all forms available were described; a list of all genera and species unknown to me, with all localities mentioned in the literature of the subject, was put together, and an attempt was made to refer such animals to the genera or families to which they really belonged\*; the paper contains also a rather detailed representation of the appendages, especially of the mouth-parts. These particulars are mentioned here because in the following treatise that paper is taken as the starting-point. I have nothing to add to my earlier investigation of the mouth-parts and other appendages, the antennæ excepted; further, the reader is referred to the numerous figures of several species and to the detailed account of biology, earlier synonymy, &c., given in that paper, but omitted here in order to avoid unnecessary reprinting of these portions.

Since 1890 many authors, viz., J. Bonnier, A. Dollfus, P. Gourret, H. J. Hansen, S. Lo Bianco, G. O. Sars, T. Scott, T. R. R. Stebbing, and A. O. Walker, have published papers containing contributions to our knowledge of the European marine forms of the group; several new species have been established, and especially numerous new localities for earlier known species have been enumerated. These treatises are registered in the "List of Papers" (p. 370), and an abstract of their contents is given under the species in question, but two of them must, nevertheless, be mentioned here. In the paper "*Isopoden, Cumaceen und Stomatopoden der*

\* Several of the descriptions are unfortunately so imperfect that I could only doubtfully locate the various forms.

Plankton-Expedition," 1895, I attempted tentatively to procure equivalence between the families of the order Isopoda; the family Cymothoidæ sens. lat. was established as equivalent with Sphæromidæ, Bopyridæ, or Epicaridæ, &c.; the six families Cirolanidæ, Corallanidæ, Alcironidæ, Barybrotidæ, Ægidæ, and Cymothoidæ, accepted or established by me in 1890 in the above-named paper, were now considered as subfamilies (*Cirolaninæ*, &c.) of the family Cymothoidæ. This explains the use of the name *Cirolaninæ* in the title of the present treatise. In 1903 A. Dollfus published "Note préliminaire sur les espèces du genre *Cirolana* . . . de l'Hirondelle et de la Princesse-Alice" (Bull. Soc. Zool. France, vol. xxviii. pp. 5-10); the author describes a new deep-sea species from the Mediterranean, and enumerates numerous new localities for some other species.

In 1902 my friend, the Rev. Canon A. M. Norman, urged me to work out some *Cirolaninæ* preserved in his splendid collection of European marine Invertebrates, among which was *Eurydice polydendrica*, Norm. & Stebb., published as a *nomen nudum* many years ago: I promised to do so. In 1890, M. A. Dollfus sent me a considerable number of French *Cirolaninæ*, among which I found one new species of *Eurydice*. Then I resolved to write a revision of the European marine species. In order to get more material, I applied to Professor Yves Delage, who kindly forwarded a vast number of *Conilera cylindracea* and of a species of *Cirolana* which, to my great astonishment, proved to be a new form. I beg these three gentlemen to accept my sincere thanks. Finally, I inserted the material received by the Copenhagen Museum since 1890 from various sources.

As stated in the title, the aim of the present treatise is to give a revision of the European marine forms of the subfamily, while the freshwater forms found in France are omitted from want of material. Before 1890 six valid species had been described (the rather doubtful *Eurydice pontica*, Czern., not included); in 1890 I added three species, and since that year three valid species have been found or described. The total was thus 12 species. In the present paper I add three more species; so that the total is now 15 species, belonging to the three genera *Cirolana*, *Conilera*, and *Eurydice*, all established by Leach. Of *Eurydice* only two species, viz. *E. pulchra*, Leach, and the female of *E. truncata*, Norm., were known before 1890; I am now able to enumerate six European species. But these species, though

exhibiting excellent specific characters, are closely allied and so similar in general aspect, size, and colour, that authors have certainly often committed mistakes in naming their material; for this reason I think that at least some of the statements in the literature on the occurrence of the species, especially *E. pulchra*, are erroneous and misleading. Furthermore, the discovery of a new and large species of *Cirolana* in abundance on the northern coast of France, and closely allied to *C. borealis*, proves that great caution is necessary in determining species of this group. In the following account I shall endeavour to distinguish as well as possible between trustworthy and doubtful statements as to localities, but where no description or figures are given it is, of course, only a kind of calculation of probabilities, and even a gross error may readily escape discovery.

*Conspectus of the Genera* \*.

- A. Peduncle of antennæ with at least five very distinct, movable joints†. Lobe from second joint of the maxillipeds furnished with one hook or two or three hooks. Peduncle of uropods produced considerably or much backwards, so that the articulation between peduncle and endopod is rather long.
- a. First and second pairs of pleopoda subsimilar, with the endopod submembranaceous; peduncle of first pair much broader than long ..... I. *CIROLANA*, Leach.
- b. First pair of pleopoda very firmly chitinized everywhere, constituting a large operculum, with the peduncle longer than broad and the inner branch elongate; second pair of pleopoda with both rami submembranaceous and the peduncle broader than long ..... II. *CONILERA*, Leach.

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\* This key is in the main only a translation of the Latin conspectus in my monograph.

† In 1890 I described and figured five joints in the peduncle of the antennæ in *Cirolana*. In the paper, "The Deep-sea Isopod *Anuropus branchiatus*, Bedd., and some Remarks on *Bathynomus giganteus*, A. M.-Edw." (Journ. Linn. Soc., Zool. vol. xxix. pp. 12-25, 1903), I showed that this peduncle in *Bathynomus giganteus* consists of six movable joints. Having found the basal joint hitherto overlooked in this animal, I was able to point out the same joint in *Cirolana borealis* and *C. Cranchii*: the joint is distinct, situated at the outer margin of the joint hitherto considered as the first, but it is not easy to catch sight of; it is probably found in all species of *Cirolana*, and I have besides observed it in *Conilera*. The mode of expression in the conspectus is chosen for practical reasons.

B. Peduncle of antennæ with only four distinct joints.

Lobe from second joint of the maxillipeds without hooks\*. Peduncle of uropods slightly produced backwards, and the articulation between peduncle and inner branch short ..... III. EURYDICE, Leach.

# I. CIROLANA, Leach.

The characters of the genus are given in the conspectus of the genera.

## Conspectus of the Species.

A. Frontal plate elongate, at least nearly three times longer than broad. Three posterior pairs and especially seventh pair of thoracic legs with many long plumose natatory setæ.

a. Eyes very distinct, generally brownish or black, but if colourless the facetting is seen.

a. Seventh thoracic legs have the second joint† strongly flattened and expanded, at most only twice as long as broad, with a close row of long natatory setæ along the outer margin; fourth joint not longer than sixth.

§ Major portion of upper margin of the eyes straight.

Four posterior pairs of thoracic epimera completely without oblique ridge or furrow—only with the usual furrow along the lower margin ..... 1. *C. borealis*, Lilljeb.

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\* This character, which may be considered interesting, was pointed out by me in 1890. G. O. Sars gives in his 'Crustacea of Norway,' vol. ii. pl. 30. fig. 2 *mp.*, a drawing of the left maxilliped of *Eurydice pulchra*, on the lobe from the second joint of the maxillipeds two small hooks are shown; but I have re-examined the maxillipeds of this species, and can repeat my earlier statement that such hooks do not exist. In the text (p. 73) Sars writes only: "Oral parts on the whole resembling those in *Cirolana*." In the description of the genus *Cirolana* he says that the lobe mentioned has "2 curved hooks inside," but in *C. borealis* I had found and figured three hooks, and also stated (*Cirolanidæ* &c. p. 278) that in this genus the number varied from one to three. Moreover, Sars ought to have added that his figure represented the maxilliped of an ovigerous female, the large plate from the second joint being wanting in the male. Finally, it may be mentioned that he has overlooked the second of the two best characters for the genus *Eurydice*, viz., that the peduncle of the antennæ is four-jointed. If that highly talented and most meritorious author would use the literature somewhat better than he frequently does, he would avoid several errors, &c.

† The "epimera" on the second to seventh thoracic segments here and in the following descriptions counted as the first joint of the legs.



§§ Upper margin of eyes convex. Four posterior pairs of thoracic epimera each with a conspicuous oblique furrow besides the furrow along the lower margin.

† Eyes black. Seventh thoracic legs closely set with natatory setæ along the whole inner margin of second joint. Hind margin of last abdominal segment with only two pairs of spines. Endopod of uropods somewhat more than two and a half times as long as broad.

2. *C. gallica*, n. sp.

†† Eyes light brownish or colourless. Seventh thoracic legs without setæ along the major portion of inner margin of second joint. Hind margin of last abdominal segment with five or six pairs of spines. Endopod of uropods slightly more than twice as long as broad..... 3. *C. neglecta*, H. J. H.

β. Seventh thoracic legs have the second joint about three and a half times as long as broad, and on its outer margin only a few short setæ; fourth joint much longer than sixth..... 6. *C. microphthalmia*,

b. No eyes. [Hoek.]

a. All six pairs of thoracic epimera with the oblique furrows well developed ..... 4. *C. Schmidtii*, n. sp.

β. All six pairs of thoracic epimera without furrows.

5. *C. cæca*, Dollf.

B. Frontal plate at most half as long again as broad. Three posterior pairs of thoracic legs without natatory setæ, or at most with a few plumose setæ at the outer margin of second joint.

a. Frontal plate small, not visible from above, its lower surface without any impressed area. Clypeus without any free process. Eyes rather large.

7. *C. Cranchii*, Leach.

b. Frontal plate very large, its front end visible from above; its lower surface with a large oblong impressed area. Clypeus protruding freely in front as a nearly lamellar process. Eyes small.

8. *C. Hanseni*, Bonn.

*Group A.*

Frontal plate elongate, at least nearly three times longer than broad. Three posterior pairs and especially seventh pair of thoracic legs with a great number of long plumose natatory setæ.

1. *CIROLANA BOREALIS*, *Lilljeborg* (1852).

1890. *Cirolana borealis*, H. J. Hansen, *Cirolanidæ*, &c., p. 321, pl. i. figs. 1-1 v (with synonymy).

1897. *Cirolana borealis*, G. O. Sars, *Crust. of Norway*, vol. ii. p. 70, pl. 29.

Eyes blackish, seen from the side somewhat longer than deep, with the major portion of the upper margin straight.

Frontal plate about three times longer than broad; its front end not visible from above. Clypeus without anterior process; its surface feebly convex, with a deep furrow along each lateral margin.

Antennulæ considerably shorter than the peduncle of the antennæ; flagellum consists of numerous very short joints.

Antennæ reach almost or about to the middle of thorax; flagellum with numerous (about thirty) joints.

Epimera of second and third thoracic segments with a short rudiment of an impressed line besides the submarginal furrow; epimera of fourth to seventh segments without any furrow or ridge besides the submarginal one; epimera of seventh segment somewhat smaller than those of the sixth.

Seventh thoracic legs have second joint strongly flattened and expanded, somewhat less than twice as long as broad, with both lateral margins and the longitudinal ridge along the middle of the lower side very closely set along their whole length with long plumose setæ. Fourth joint scarcely longer than fifth and somewhat shorter than sixth.

Last abdominal segment with the lateral margins convex, not angular at the beginning of the terminal third; this distal part with about four pairs of marginal spines; the tip moderately angular, scarcely acute.

Uropoda slender. The endopod, which, when directed parallel with the axis of the animal, reaches somewhat beyond the end of abdomen, is somewhat more than two and a half but not fully three times longer than broad, without notch at the end of the outer margin. Exopod at least four times longer than broad and considerably shorter than the endopod, with about four spines along the outer margin.

Length 27-33 mm.

*Occurrence.*—In 1890 I gave a detailed criticism of the synonymical confusion and full account of the localities, dividing these into two portions: one comprising those which are certain or at least highly probable, the other portion including a number of doubtful statements. Since 1890 Dollfus has published some localities of importance, but otherwise little has been added to our knowledge. In Mr. Dollfus's collection I have found material from some new places: Belle-Isle (off the south-western coast of Brittany), 60 and 100 metres; Firth of Clyde; and Villefranche. Further, I have seen nine specimens taken on bait on long-lines in lat.  $61^{\circ} 6' N.$ , long.  $9^{\circ} 21' W.$ , 210 fathoms, cruise of 'Michael Sars' in 1902 (Cand. mag. Ad. Jensen.). Probably some of the localities in North-western France and Southern England mentioned in the literature refer in reality not to this, but to the following species. The specimens from the Adriatic referred by Heller, Stalio, and Stossich to *C. hirtipes*, M.-Edw., and mentioned with much doubt by me in 1890, probably belong to *C. neglecta*, H. J. Hansen; the specimen from Mr. Krupp's collection, mentioned by Lo Bianco in 1902 (Mitt. Zool. Stat. Neap. xvi. p. 258) as *C. hirtipes*, is probably *C. borealis*.

Our present knowledge may be summed up as follows. The species has been taken in various places in the Kattegat, 13–29 fathoms; along the southern and western coasts of Norway "at least to the Trondhjem Fjord" (G. O. Sars); in lat.  $64^{\circ} 48' N.$ , long.  $6^{\circ} 32' E.$  (G. O. Sars); Shetland Isles (Norman); several places on the coasts of Scotland and Ireland (various authors); on the northern part of the western coast of France; in the Mediterranean at Villefranche, and at Naples, 25 fathoms (Hansen), and, according to Dollfus, in various places in the western half of that sea at depths ranging from 280 to 1210 metres. It has also been found off the eastern coast of North America between lat.  $32^{\circ}$  and  $33^{\circ} N.$ , long.  $77\frac{1}{3}^{\circ}$  and  $78\frac{2}{3}^{\circ} W.$ , 233 and 229 fathoms (Harger); finally, according to Miss Richardson, "off Cape Florida," but this statement is, in my opinion, rather doubtful and needs confirmation.

*Remarks.*—This species is easily distinguished from all other forms hitherto known by the characters pointed out in the eyes, epimera, seventh thoracic legs, uropoda, and armature of last abdominal segment.

2. *CIROLANA GALLICA*, n. sp. (Pl. 33. figs. 1 a-1 d.)

Eyes black, seen from the side slightly or scarcely longer than deep, with the upper margin rather convex.

Frontal plate, clypeus, and antennulæ much as in *C. borealis*.

Antennæ shorter than in the preceding species, reaching almost to second thoracic segment; flagellum with about twenty-two joints.

Epimera of second and third thoracic segments with a long, slightly curved, and somewhat oblique furrow besides the submarginal one; epimera of fourth to seventh segments shaped as in *C. borealis*, but furnished with a very oblique furrow which on fourth to sixth, not on last segment, reaches to their posterior margin.

Seventh thoracic legs have the second joint strongly flattened and extremely expanded, nearly two-thirds as broad as long, with both lateral margins and the longitudinal ridge on the lower side very closely set along their whole length with long plumose setæ. Fourth joint very conspicuously longer than the fifth and slightly shorter than sixth.

Last abdominal segment with the lateral margins convex, not angular at the beginning of the terminal third; only two pairs of spines on the distal margin; the end is sharply angular.

Uropoda slender. The endopod, which, when parallel with the axis of the animal, reaches a little beyond the end of abdomen, is somewhat more than two and a half but not fully three times as long as broad, without distinct notch near the end of the outer margin. Exopod at least four times longer than broad and considerably shorter than the endopod, with a few (two or three) spines along the outer margin.

Length:—One of the largest specimens, a male, measures 20 mm., but whether the animal is really adult or not cannot be settled. Female with marsupium unknown.

*Occurrence*.—Roscoff, or perhaps Guernsey or Jersey. A large number of specimens belonging to the maritime station of Roscoff have been kindly sent to me by Professor Yves Delage.

*Remarks*.—This species is rather closely allied to *C. borealis*, but it is easily distinguished by a number of characters, among which those used in the conspectus are very easily observed. *C. gallica* has in all probability been seen before now and confounded with *C. borealis*. I think it very likely that it will be found on the southern coasts of England and Ireland, and on the western coasts of France, Spain, and Portugal.

3. *CIROLANA NEGLECTA*, *H. J. Hansen* (1890).

1890. *Cirolana neglecta*, H. J. Hansen, *Cirolanidæ*, &c., p. 327, pl. i. figs. 3-3*i*; pl. ii. figs. 1-1*b*.

1903. *Cirolana neglecta*, A. Dollfus, *Bull. Soc. Zool. France*, vol. xxviii. p. 7.

Eyes light brown (or colourless, according to Dollfus); seen from the side a little shorter than deep, with the upper margin strongly convex.

Frontal plate, clypeus, and antennulæ differ slightly from the same parts in *C. borealis*; antennulæ, however, somewhat less robust, with the flagellum proportionately a little longer.

Antennæ reach almost to the middle of thorax; flagellum with about twenty-two joints.

Epimera of the thoracic segments shaped and furrowed nearly as in *C. gallica*, but the furrows are deeper; seventh epimera somewhat larger and more produced than in that species, but yet shorter than the sixth, with its oblique furrow extending to the posterior margin.

Seventh thoracic legs have the second joint strongly flattened and expanded, a little less than twice as long as broad; its outer lateral margin and the longitudinal ridge on the lower side closely set along their whole length with plumose setæ, which are long on the margin, much shorter on the ridge; while the major portion of its inner margin is naked, and very long plumose hairs are found along its most distal, strongly rounded part. Fourth joint is slightly shorter than fifth and very conspicuously shorter than sixth.

Last abdominal segment with the proximal two-thirds of the lateral margins slightly convex, the terminal third more oblique and forming a very obtuse angle with the proximal portion; the terminal third is armed with about five pairs of marginal spines; the end is conspicuously angular.

Uropoda conspicuously broader than in the two preceding species. Endopod, which reaches slightly beyond the abdomen, is slightly more than twice as long as broad, without any notch at the end of the outer margin. Exopod not fully three times as long as broad and considerably shorter than the endopod, with several spines at the outer margins.

Length 12-15 mm.

*Occurrence*.—The species was established on specimens from Naples and a specimen probably from Nice; some of the



specimens from Naples were taken in a depth of about 25 fathoms together with *C. borealis*. In material received from Mr. Dollfus was found a large number of specimens from Le Croisic (south-western coast of Brittany), captured by E. Chevreux, and some specimens from Villefranche. The specimens from the Adriatic wrongly referred to *C. hirtipes*, H. M.-Edw., by Heller, Stalio, and Stossich, belong in all probability to *C. neglecta*. Dollfus enumerates (*l. c.*) nine stations in the western part of the Atlantic; one of these is near Belle-Isle (not very far from the south-western coast of Brittany), 19 m., while the remaining eight stations are between lat.  $39^{\circ} 18'$  N. and lat.  $30^{\circ} 1\frac{1}{2}'$  N., with depths from 1007 down to 1924 m.; finally, he has seen specimens from the Bay of Giardini, Sicily, 16 m., and from the Adriatic. Dollfus states that the pigmentation of the eyes is still distinct in specimens captured at depths down to 1200 m., but disappears completely in the animals from greater depths, though the eyes always exist. It may be taken as certain that his specimens from deep water belong to this species, while I am inclined to suppose that all those from 1007 to 1924 m. belong to a species closely allied to *C. neglecta*; but not having seen any of these specimens, I cannot settle the question. I may add that it is probably almost without parallel that a species which has been taken in several places far from each other in depths ranging from about 8 to 25 fathoms, should not occur in depths from about 25 (or at most 50 fathoms) and down to more than 500 fathoms, but yet should have been found not less than eight times in depths from about 550 to 1000 fathoms. Besides, I can state from personal experience that species of the genus *Cirolana* are frequently so closely allied that a minute examination of the shape of the posterior thoracic epimera, the shape and armature of last abdominal segment, the length and breadth of the rami of the uropoda, the distribution of plumose setæ on seventh thoracic legs, &c., is necessary in order to avoid erroneous determination.

*Remarks.*—This species is distinguished from the two preceding forms by shape and colour of the eyes, the posterior thoracic epimera, the second joint of seventh thoracic legs, the shape and armature of last abdominal segment, and the comparatively greater breadth of the rami of the uropoda. In the paragraph on occurrence and distribution some further remarks on the species—or two species—are found.

4. *CIROLANA SCHMIDTII*, n. sp. (Pl. 33. figs. 2 *a*-2 *c*.)

Adult female and immature specimens.

Eyes completely wanting; the lateral margins of the head show a kind of ridge from the base of the antennula to the front angle of thorax, and the lower side of the head close inside that ridge is conspicuously excavated.

Frontal plate about as in *C. borealis*. Clypeus considerably shorter than in *C. borealis* or *C. neglecta*, with the usual marginal furrows, but the area limited by these furrows is scarcely convex.

Antennulæ nearly as in *C. neglecta*; flagellum with about twelve very short joints.

Antennæ do not reach fully to the middle of thorax; flagellum in the two largest specimens with about twenty joints.

Epimera nearly as in *C. neglecta*, but those of seventh segment a little less produced; the oblique furrow well developed on all epimera, reaching their posterior margin.

Seventh thoracic legs more slender than in the preceding species; otherwise nearly as in *C. neglecta*. Second joint strongly flattened and considerably expanded, a little more than twice as long as broad; its outer margin and the ridge on the lower surface closely set with plumose hairs, which are long at the margin, much shorter on the ridge; the inner margin is naked nearly to the most distal, almost transverse short part, which is closely set with exceedingly long plumose setæ. Fourth joint as long as the fifth and slightly shorter than the sixth.

Last abdominal segment with a subbasal transverse impression more pronounced than in the preceding species; the lateral margins rather feebly convex, not angular, with six pairs of distal spines; the end is more or less acute.

Uropoda broader than in *C. borealis*, but less broad than in *C. neglecta*. The endopod, which reaches slightly beyond the tip of abdomen, is rather more than twice as long as broad, without any notch at the end of the outer margin. Exopod between four and three and a half times longer than broad, considerably shorter than the endopod.

Length of a female with marsupium 12 mm.; the immature specimen, parts of which are shown on the Plate, measures 9.5 mm. in length.

*Occurrence*.—In 1895 an adult female and two rather small specimens were taken by the 'Ingolf' Expedition in the Davis

Strait, Station 25: lat.  $63^{\circ} 30' N.$ , long.  $54^{\circ} 25' W.$ , 582 fathoms, temperature at the bottom  $3^{\circ} 6' C.$  In May 1904, the specimen figured was captured west of the most southern of the Færoe Islands, in lat.  $61^{\circ} 15' N.$ , long.  $9^{\circ} 35' W.$ , 872–970 metres, by Dr. Joh. Schmidt (the cruise of the 'Thor,' the Danish ship in the service of the international marine investigations of the Northern European Seas).

*Remarks.*—The species is rather closely allied to *C. neglecta*, H. J. H., but distinguished at a glance by the complete absence of visual elements and the shape of the lateral part of the head; besides it shows several minor differences pointed out in the description. From *C. cæca*, Dollf., it differs in possessing well-developed furrows on the thoracic epimera. The name is chosen in honour of Dr. Joh. Schmidt, who during the cruises of the 'Thor' in the seas of Iceland and the Færoe Islands collected a great number of interesting Crustacea (and other animals), several of which are new to science.

5. *CIROLANA CÆCA*, Dollf. (1903).

1903. *Cirolana cæca*, A. Dollfus, Bull. Soc. Zool. France, vol. xxviii, p. 6.

Eyes quite wanting.

Frontal plate "very narrow, longitudinally canaliculated, about three times as long as broad."

Antennulæ short, with three-jointed peduncle, and flagellum consisting of twenty or twenty-one joints.

Epimera of second to sixth thoracic segments without any trace of oblique furrow, while the usual submarginal furrow is conspicuous. Seventh epimera considerably smaller than the sixth, with the oblique furrow rather feebly developed.

Seventh thoracic legs have the second joint shaped nearly as in *C. Schmidtii*, with the natatory setæ distributed as in this species.

Last abdominal segment subtriangular, proportionately a little longer than in *C. Schmidtii*, with the end narrowly rounded.

Uropoda nearly as in *C. Schmidtii*; the endopod not quite so broad as in that species.

The species is rather closely allied to *C. Schmidtii*.

Length of an egg-bearing female, 9 mm.

*Occurrence.*—Dollfus enumerates five stations in the western half of the Mediterranean, with depths from 1210 to 2500 m.

'Porcupine' (1869) St. 36 : lat.  $48^{\circ} 50'$  N., long.  $11^{\circ} 9'$  W., 725 fathoms (the locality at the entrance of the English Channel), one specimen in Canon Norman's Collection.

*Remarks*.—Of this small and blind deep-sea species only a preliminary description, without figures, has been published. [In the original manuscript I gave only an abstract of this description; but having subsequently received a specimen from Canon Norman, some additional observations have been inserted. *C. cæca* is sharply distinguished from *C. Schmidtii* and *C. neglecta* by the absence of eyes and of furrows on the epimera; it is much more related to the preceding species than to *C. microphthalmæ*, Hoek, and allied exotic forms.]

# 6. CIROLANA MICROPHTHALMA, Hoek (1882).

1882. *Cirolana microphthalmæ*, Hoek, Nied. Archiv für Zool., Supplementband, i. p. 28, pl. ii. figs. 13–17.

1897. *Cirolana microphthalmæ*, G. O. Sars, Crust. of Norway, vol. ii. p. 71, pl. 36. fig. 1.

1903. *Cirolana microphthalmæ*, Dollfus, Bull. Soc. Zool. France, vol. xxviii. p. 9.

“Eyes very small, black.”

Frontal plate “narrow, elongate and canaliculated.”

Antennulæ about as long as the peduncle of the antennæ, rather similar to those of *C. borealis*.

Antennæ with the flagellum very much shorter than in *C. borealis*, *C. gallica*, or *C. neglecta*, consisting of at most thirteen joints.

(Epimera of seventh thoracic segment probably considerably larger in proportion to those of sixth segment than in *C. gallica* or *C. neglecta*.)

Seventh thoracic legs have the second joint less flattened and about three and a half times longer than broad, with a few short setæ near the base of the outer margin, no setæ on the inner margin except on its distal end, and a rather small number of setæ along the ridge on the lower surface. Fourth joint elongate, a little longer than the fifth and much longer than the sixth.

Last abdominal segment posteriorly either rounded or “obtusely truncated,” with about three pairs of short spines.

Uropoda moderately broad. Endopod, when directed parallel with the axis of the animal, reaches a little beyond the end of abdomen; it is nearly two and a half times as long as broad, its outer margin considerably bent—convex or nearly angular—beyond the middle, but the distal part more or less distinctly

concave. Exopod somewhat shorter than the endopod, more than four times longer than broad, "without any marginal spinules."

Length of the largest specimen known 33 mm. (Dollfus); Hoek's typical specimen measured 23 mm.

*Occurrence*.—Hoek's single specimen was captured in lat.  $73^{\circ} 13' 5''$  N., long.  $30^{\circ} 42'$  E., 166 fathoms. Sars has seen one specimen from lat.  $70^{\circ} 36'$  N., long.  $32^{\circ} 35'$  E., 148 fathoms, and a second from Storeggen (western coast of Norway), 50 fathoms. Dollfus records a single specimen from lat.  $65^{\circ} 41'$  N., on the coast of Norway, 440 m.

*Remarks*.—This species is easily distinguished from all other forms hitherto found in Europe by the shape of the seventh thoracic legs; the small black eyes, the very short antennæ, the end of abdomen, &c., exhibit other good characters.

Unfortunately I have seen no specimen of this interesting form; my diagnosis has been compiled from the descriptions of the three authors in question, to which I add characters to be seen especially on the figures given by Sars. It was necessary to do so, because the descriptions named are rather incomplete; furthermore, no figure of the thoracic epimera, seen from the side, has been published, and these epimera have not been described.

The species is rather closely allied to *C. concharum*, Stimps., *C. polita*, Stimps., and *C. impressa*, Harger, all from the eastern coast of the United States. It is to be hoped that a more detailed description with some additional correct figures may soon be published, so that it may be easily distinguished from the American species mentioned; moreover, I do not think it impossible that one of these American forms may eventually be discovered in European seas.

### Group B.

Frontal plate at most half as long again as broad. Three posterior pairs of thoracic legs without natatory setæ, or at most with a few plumose setæ at the outer margin of second joint.

#### 7. CIROLANA CRANCHII, Leach (1818). (Pl. 33. fig. 3 a.)

1890. *Cirolana Cranchii*, H. J. Hansen, Cirolanidæ, &c., p. 341, pl. iii. figs. 3-3 i.

1892. *Conilera grampoides*, P. Gourret, Ann. Mus. d'Hist. natur. Marseille, vol. iv. fasc. ii. Zool. Mém. 1, p. 11, pl. i. fig. 7; pl. iii. figs. 4-11.



Eyes moderately large, black, seen from the side longer than deep, with the upper margin slightly convex.

Frontal plate small, pentagonal, at most one half as long again as broad; its front end acute, not visible from above. Clypeus without any anterior process; its surface slightly convex, with a furrow along each lateral margin.

Antennulæ about as long as the peduncle of the antennæ; flagellum moderately slender, with about fifteen joints.

Antennæ long, reaching much beyond the middle of thorax; flagellum with numerous, sometimes even more than forty, joints.

Epimera of the thoracic segments increase gradually in size backwards; each has a deep oblique furrow besides the sub-marginal one.

Seventh thoracic legs without natatory setæ but with numerous simple, acute spines, and some very short hairs; second joint very robust, twice as long as broad; fourth joint a little shorter than fifth, which is somewhat shorter than sixth.

Last abdominal segment subtriangular, posteriorly rather narrowly rounded, with four to six pairs of marginal spines.

Uropoda rather broad. Endopod, when directed parallel with the axis of the animal, reaches considerably beyond the end of abdomen; it is from a little less (in small specimens) to a little more (in large specimens) than twice as long as broad. Exopod about three times as long as broad, somewhat shorter than the endopod.

*Differences according to Age.*—Large, and especially very large, specimens differ from smaller ones in shape and clothing of last abdominal segment and uropoda. In smaller specimens the upper surface of this segment is distinctly convex, glabrous, or at most with a number of nearly inconspicuous elevated points, while the distal half of the lateral margins is feebly convex or at most straight. In large, and especially in very large, specimens a large portion of the upper surface is flat or even slightly depressed, adorned with numerous conspicuous elevated points; the distal half of the lateral margins is a little concave, wherefore the corresponding part of the segment is more narrow than in young specimens. The uropoda show the following differences. In smaller specimens the outer margin of the endopod is rather regularly but feebly convex and the end acute; on both rami the clothing of setæ is of normal density on both margins, so that all marginal spines are easily seen. In large, and especially very

large, specimens the outer margin of the endopod is a little bent before or beyond the middle, the margin beyond this very obtuse angle is straight, and the end is more or less rounded; this straight part of the outer margin of the endopod and the distal half or two-fifths of both margins of the exopod are so densely clothed with fine hairs that the marginal spines, if present, cannot be perceived; the clothed portion of the exopod has also altered its shape a little.

Pl. iii. fig. 3 *z*, in my paper quoted, conveys a good idea of the shape and clothing of spines and setæ of the last abdominal segment and uropoda in smaller specimens. Fig. 2 *g*, on the same plate, represents the same parts of a rather large animal, in which the shape of abdomen is seen, while the uropoda have not fully arrived at their final shape. For this reason I give here a new figure (Pl. 33. fig. 3 *a*) of the right uropod of a large specimen.

Length of the largest specimen seen, a female without marsupium, taken at Belle-Isle, is 18 mm.

*Occurrence*.—According to the literature this species has been secured at Cumbrae (Firth of Clyde, western coast of Scotland), Plymouth and Falmouth (Sp. Bate & Westwood), the Channel Islands, Roscoff, Concarneau and Le Croisic (various French authors); my earlier specimens were from Villefranche, and Leach had his *Nelocira Swainsoni* from Sicily; Miers mentions the species from Goree Island, Senegambia, but the specimens from this locality ought to be re-examined. Mr. Dollfus's collection contains many specimens from the following localities:—Le Croisic, two very small specimens in a dead *Cancer pagurus* and two specimens in a *Maja*; Belle-Isle, one specimen from 70 m., and two specimens in cavities in a piece of wood hauled up in the dredge; Isle d'Yeu, one specimen from 100 m.; Guéthary, near Biarritz: all four localities are on the western coast of France. Also from the following places in the Mediterranean: Villefranche; Cannes, 1–5 m.; not far from Toulon, ten small specimens in the mouth of *Grampus griseus*; Porto Vecchio (Corsica); finally Gabès (Tunis), in sponges.

*Remarks*.—*C. Cranchii* is easily distinguished from all other European species by the shape of the frontal plate; eyes, epimera, thoracic legs, &c. show other excellent characters. As to the synonymy, especially Leach, Risso, and G. O. Sars, I refer to my earlier paper. In 1892, P. Gourret established a new form, *Conilera grampoides*, on ten specimens taken in the mouth of a

*Grampus griseus*. I applied to the zoological authorities in Marseilles in order to obtain Gourret's types for study, but in spite of careful searching they could not be found and are probably lost. His description and most of his figures are not sufficient for recognition of the species; but according to his fig. 9, which represents the abdomen and one of the uropoda, the animals do not belong to *Conilera*, but are young stretched specimens of *Cirolana Cranchii*.

8. *CIROLANA HANSENI*, Bonn. (1896). (Pl. 33. figs. 4 a-4 d; Pl. 34. figs. 1 a-1 k.)

1882. *Eurydice polydendrica*, Norman & Stebbing, Proc. Roy. Soc. Edinburgh, vol. xi. pp. 665 & 684. [*Nomen nudum*, without description or figures.]

1896. *Cirolana Hanseni*, J. Bonnier, "Campagne du Caudan," Ann. l'Univers. Lyon, t. xxvi. p. 574, pl. xxxii. figs. 1 a-1 o.

Head more or less angular in front of the small black eyes.

Frontal plate very large, slightly longer than broad, increasing much in breadth from the middle to the anterior end, which is cut off with the front margin slightly concave. Between this lower front margin and the anterior end of the process (between the antennulæ) from the upper surface of the head the frontal plate shows a triangular surface looking forwards, and this surface is partly visible when the head is seen from above. On the lower side of the plate the lateral margins and the front margin are thickened, forming elevated ridges between which an impressed area is seen.

Clypeus anteriorly produced into a triangular, basally very broad and distally rounded, nearly lamellar process, which proceeds downwards and forwards below the basal part of the frontal plate.

Antennulæ slender, somewhat longer than the peduncle of the antennæ; peduncle three-jointed; the flagellum consists of four proportionately long and some minute joints.

Antennæ do not reach to the middle of thorax; flagellum about as long as the peduncle, with eleven joints.

Epimera of the thoracic segments increase in size and in the degree of being produced backwards from the second to the sixth, while the seventh is considerably smaller than the sixth. All epimera are strongly carinated, and the posterior pairs rather excavated behind their oblique carina.

Seventh thoracic legs unusually slender. Second joint somewhat more than three times as long as broad, along the outer margin with several very short hairs and a few long setæ, each of which has proportionately few long lateral branches; the other margin and the lower surface without setæ. Fourth joint much longer than broad, much shorter than fifth and scarcely more than half as long as the sixth; these joints without setæ, but with some slender spines.

Abdomen increases much in breadth from first to third segment. Lateral angles of fifth segment covered by the fourth.

Last abdominal segment almost as long as broad, posteriorly broadly rounded and irregularly serrate, probably without marginal spines, but with setæ in the incisions between the saw-teeth.

Uropoda broad. Endopod, when parallel with the axis of the animal, reaches scarcely beyond the end of abdomen; it is nearly twice as long as broad, with some coarse serrations along each margin, its end with a small incision between two saw-teeth. Exopod much shorter than the endopod, not fully three times longer than broad; its end shaped and its margins serrate nearly as those of the endopod. Both rami without movable spines, but with setæ as on the distal margin of abdomen.

Length of the largest specimen (Norman's type) 4.2 mm.

*Occurrence*.—Norman mentions the species from lat.  $59^{\circ} 37' N.$ , long.  $7^{\circ} 19' W.$ , 530 fathoms; in material received from him I found one specimen from lat.  $59^{\circ} 34' N.$ , long.  $7^{\circ} 18' W.$ , 543 fathoms, and three specimens from lat.  $59^{\circ} 70' N.$ , long.  $7^{\circ} 21' W.$ , 516 fathoms (H.M.S. 'Triton,' 1882). Bonnier's single specimen was dredged in the Gulf of Gascogne (Bay of Biscay), lat.  $44^{\circ} 36' N.$ , long.  $4^{\circ} 25' W.$ , 650 m.

*Remarks*.—This species differs—especially in the frontal plate, clypeus, and seventh thoracic legs—strongly from all other European forms, but is rather closely allied to *C. japonica*, H. J. H. Probably all specimens seen by me are immature; unfortunately the largest specimen was exsiccated, the glass tube being crushed on the way from Berkhamsted to Copenhagen.

A long time after I had finished the drawings of this species I became aware that the minute specimen—measuring 1.7 mm. in length—described and figured by Bonnier was the same form. As *Eurydice polydendrica*, Norm. & Stebb., had never been described nor figured, it was necessary to drop this name and

adopt that given by the French author.—On Pl. 34 I have figured the mouth-limbs from the left half of a specimen; they show great similarity to those of *C. japonica*, H. J. Hansen (Cirolanidæ, pl. 4).

## II. CONILERA, *Leach*.

The characters of the genus are given in the conspectus of the genera.

The genus comprises as yet only one marine species, *C. cylindracea*, Mont. (and an American freshwater form). I have stated above that *Conilera grampoides*, Gourret, does not belong to this genus, but that the form is only *Cirolana Cranchii*, Leach.

### 1. CONILERA CYLINDRACEA, *Mont.* (1803).

1868. *Conilera cylindracea*, Sp. Bate & Westwood, Brit. Sess.-eyed Crust. vol. i. p. 304 [with figures].

1890. *Conilera cylindracea*, H. J. Hansen, Cirolanidæ, &c. p. 358, pl. iv. figs. 5-5c; pl. v. figs. 1-1d [with synonymy, biology, &c.].

A detailed description, with several figures, of this characteristic very slender form will be found in my paper quoted. It is deemed sufficient to give here some remarks on dimension, variation, and distribution.

*Length*.—An egg-bearing female and a male from Naples measured respectively 19·3 mm. and 20·5 mm. in length. Some specimens in a very rich material from Roscoff are considerably larger—the largest one, a female without marsupium, measuring 28·7 mm. in length and 5·5 mm. in breadth.

*Variation*.—In my previous paper I have drawn attention to some utterances by Yves Delage in 1881 and R. Koehler in 1885. Delage writes that his *Conilera* from Roscoff is perhaps not identical with the species described by Bate & Westwood, differing “par les antennes, par les appendices natatoires du sixième anneau abdominal et par des ponctuations rouges dont les auteurs anglais spécifient l’absence.” Koehler quotes Delage, and adds: “Je possède des *Conilera* de Naples dont les caractères s’accordent absolument avec la description des auteurs anglais et dont les échantillons de Jersey diffèrent par les caractères suivants: longueur des appendices du dernier anneau abdominal, longueur des poils portés par le quatrième article des antennes inférieures, et enfin présence sur la carapace de



nombreuses petites taches rouges." I have examined some rich material from Roscoff, but I am unable to discover any difference between specimens from this locality and those from Naples in the antennæ or the uropoda. Many of the specimens from Roscoff are adorned with a very large number of fine greyish dots; in other specimens such dots are rather few in number, and in some specimens they have completely disappeared, so that they cannot be distinguished from those from Naples; I suppose that the greyish dots are red in living animals. It may be added that specimens from Le Croisic and Concarneau presented similar dots. The absence of such dots is not always a specific difference, some specimens of *Cirolana borealis* being adorned with hundreds of dots, while very few or no dots are found on other specimens preserved in spirit.

*Occurrence.*—In my earlier paper it was stated that this interesting form had been captured on the southern and western coasts of Great Britain northwards at least to the Firth of Clyde, at the Channel Islands, Roscoff, south-western coast of Brittany, finally at Naples. A. O. Walker records it from Bantry Bay, west coast of Ireland. Mr. Dollfus's collection contains many specimens from some localities on the south-western coast of Brittany; for instance, five rather small animals taken on "la voûte palatine et orbite d'un Dauphin pris à Concarneau," and seven specimens in a *Maja* at Le Croisic.—Miss Richardson (Proc. U.S. Mus. xxiii. p. 515) states that this species has been taken in two places in the southern part of the United States, viz., "off South Carolina; between the Delta of the Mississippi and Cedar Keys, Florida." I am, however, inclined to believe that the specimens in question belong to an undescribed species, and the author does not say if she has compared them with European specimens of *C. cylindracea*.

### III. EURYDICE, *Leach*.

The essential characters of the genus are given in the conspectus of the genera.

Six species (not counting *E. pontica*, Czern.) live in the seas of Europe. All are very similar in general aspect; besides, the males of some of the species differ in certain conspicuous features more from their females than examples of the latter sex belonging to different species. Eyes, antennulæ, flagellum of antennæ, relative length of abdomen, and sometimes the uropoda

show more or less conspicuous sexual differences; among these especially the antennulæ afford good specific characters. Clypeus, epimera of the thoracic segments, seventh thoracic legs, and last abdominal segment show excellent specific characters, but scarcely any sexual difference; finally, the shape of the "appendix masculina" (second joint of the endopod) of second pleopoda differs in all species. Specimens rather far from sexual maturity differ in some features more or less from adults; especially small males differ generally from adult specimens of the same sex in the structure of the antennulæ, length of flagellum of antennæ, and relative length of abdomen, while other features, as clypeus, epimera, and shape of last abdominal segment, are nearly or quite similar in immature and adult specimens. When good material is at hand, it is possible to determine even half-grown specimens with absolute certainty; but great caution is always necessary, as the animals are closely allied to each other and far from easy to separate. It is not my intention to give very detailed descriptions; in my papers from 1890 to 1895 at least one of the sexes, and sometimes both, of five of the six species have been described and illustrated by numerous figures. Having obtained one new species, the hitherto unknown male of *E. inermis*, the female of *E. truncata*, &c., I am able to communicate some further details; besides, I shall attempt to furnish two keys and shorter descriptions as practical as possible for discrimination of the forms.

Our knowledge of the geographical distribution of the species described here is still imperfect; especially the Mediterranean has not been explored, and, for instance, the statements of Gourret and Lo Bianco on the occurrence of *E. pulchra* off the southern coast of France and off Capri are not trustworthy. It is even not improbable that some new species may be discovered in the western part of the Mediterranean or on the Atlantic coast of Spain and Portugal.

### *Conspectus of the Species.*

#### I.

- A. Posterior margin of last abdominal segment rather deeply emarginate, with two conspicuous movable spines close to each other at each end. Epimera of second to fourth thoracic segments produced into rather long processes ..... 1. *E. spinigera*, H. J. H.

- B. Posterior margin of last abdominal segment never emarginate, but conspicuously convex or nearly straight; movable spines, if present, rather small and distant from each other. Epimera of second to fourth thoracic segments either not produced or with exceedingly small processes.
- a. Posterior margin of last abdominal segment at least half as long as the breadth of the segment (at each end with a prominent tooth but without marginal spines). Processes of epimera of sixth segment moderately short, about as large as those of seventh epimera ..... 2. *E. Grimaldii*, Dollf.
- b. Posterior margin of last abdominal segment considerably less than half as long as the breadth of the segment. Processes of epimera of sixth segment either wanting or much longer than those of seventh epimera.
- α. Epimera of sixth segment with moderate or rather large processes.
- † Process from clypeus small, seen vertically from below covering a minute part of the space between the mandibular palps. Epimera of fifth segment with a conspicuous process. Posterior margin of abdomen without movable spines, at each end with a conspicuous tooth, and just outside this (in large animals) a minute protruding angle ..... 3. *E. truncata*, Norm.
- †† Process from clypeus large, seen vertically from below covering the whole space between the mandibular palps. Epimera of fifth segment without any process. Posterior margin of abdomen with four movable spines, but without any distinct tooth at the end.... 4. *E. pulchra*, Leach.
- β. Epimera of sixth segment with exceedingly small processes or without any process at all.
- † Process from clypeus of considerable size, seen vertically from below covering the major portion of the space between the mandibular palps. Posterior margin of last abdominal segment slightly longer than one-third of the breadth of the segment, with four marginal spines.
5. *E. affinis*, n. sp.
- †† Process from clypeus very small, seen vertically from below covering a minute portion of the space between the mandibular palps. Posterior margin of abdomen very short, even less than one-fourth as long as the breadth of the segment, without marginal spines. 6. *E. inermis*, H. J. H.

## II.

- A. Process of clypeus, seen vertically from below, covers at least the major portion of the space between the mandibular palps.
- a. Posterior margin of last abdominal segment rather deeply emarginate, with two conspicuous movable spines at each end. Epimera of second to fourth thoracic segments produced into rather long processes ..... 1. *E. spinigera*, H. J. H.
  - b. Posterior margin of last abdominal segment not emarginate; movable spines, if present, rather small and distant from each other. Epimera of second to fourth thoracic segments without, or at most with quite minute, processes.
    - a. Posterior margin of last abdominal segment at least half as long as the breadth of the segment, without movable spines ..... 2. *E. Grimaldii*, Dollf.
    - β. Posterior margin of last abdominal segment distinctly less than half as long as the breadth of the segment, with four movable spines.
      - † Epimera of sixth thoracic segment with moderately large processes ..... 4. *E. pulchra*, Leach.
      - †† Epimera of sixth thoracic segment not produced into processes ..... 5. *E. affinis*, n. sp.
- B. Process of clypeus, seen vertically from below, covers only a small or very small portion of the space between the mandibular palps.
- a. Epimera of fifth and seventh thoracic segments produced into rather small processes, those of sixth segment with processes of considerable size. Posterior margin of last abdominal segment one-third as long as the breadth of the segment ..... 3. *E. truncata*, Norm.
  - b. Epimera of three posterior thoracic segments at most with exceedingly small processes. Posterior margin of last abdominal segment even less than one-fourth as long as the breadth of the segment.
    - 6. *E. inermis*, H. J. H.

## 1. EURYDICE SPINIGERA, H. J. Hansen (1890).

## Male.

1890. *Eurydice spinigera*, H. J. Hansen, Cirolanidæ, &c. p. 367, pl. v. figs. 4-4c; pl. vi. figs. 1-1c.

Process from clypeus large, seen vertically from below covering the whole area between the mandibular palps.

Antennulæ reach scarcely to the front lateral angle of thorax. Peduncle rather thick, its third joint slightly shorter than the second. Flagellum rather robust; first joint about two and a half times as long as the three distal joints together, furnished with a good number of moderately long sensory hairs; terminal setæ short.

Peduncle of antennæ with the penultimate joint scarcely half as long as the terminal one.

Epimera of second thoracic segment produced into rather large, oblong processes; processes of the epimera of second to sixth segment increase gradually in size backwards, so that those of sixth segment are very long, considerably longer than in any other species; posterior margin of epimera of second to fifth segments conspicuously concave above the base of the process. Even the lateral posterior angle of first segment is produced into a rather good-sized process, and the posterior margin above its base is strongly concave. The processes from last pair of epimera are rather small.

Seventh thoracic legs less slender than in *E. Grimaldii*; fourth joint slightly longer than broad and considerably shorter than fifth; fourth and fifth joints on the lower surface with several spines more or less distant from the inner margin, and with numerous setæ more or less distant from the outer margin.

Last abdominal segment has on the upper surface a pair of deep, angular, sublateral impressions and a deep, transverse, anteriorly semicircular central impression at a short distance from the base. Hind margin about two-fifths as long as the breadth of the segment, rather deeply emarginate; lateral angles broadly rounded, each with two movable spines near each other, the inner of which is long.

Uropoda rather large; endopod, when parallel with the axis of the animal, reaches slightly beyond the abdomen.

Length 9 mm.

*Occurrence*.—The species was established on a large number of specimens, without locality, forwarded many years ago by Mr. A. H. Riise, apothecary in St. Thomas Island. Mr. Riise had presented the Copenhagen Museum with a rich collection of Crustacea (and numerous other marine animals), almost all collected by himself at the Danish Islands in the West Indies; for that reason I wrote in 1890 that this species was probably from the West Indies, but this supposition must be erroneous,



as since 1890 the species has been secured twice in England. I therefore now think that my specimens were captured somewhere in the eastern part of the Atlantic, on the way from Denmark to St. Thomas. Stebbing (1895) has discovered *E. spinigera* at Ilfracombe, at the entrance of the Bristol Channel, and his remarks as to its characters prove the correctness of the determination. In 1903 Canon A. M. Norman told me in a letter that he the same summer had captured this species at Plymouth. Finally, A. O. Walker & J. Hornell (Journ. Marine Zool. ii. p. 51) record it from the Channel Islands, but as they add the erroneous remark, "probably identical with *E. truncata*, Norman," the determination is, in my opinion, less trustworthy.

*Remarks.*—This rather large species is easily separated from all other forms by the highly-developed armature of the thoracic segments and by the shape and armature of the posterior margin of abdomen.

## 2. EURYDICE GRIMALDII, Dollf. (1888).

Male and female.

1888. *Eurydice Grimaldii*, A. Dollfus, Bull. Soc. Zool. France, vol. xiii. p. 6.

1890. *Eurydice elegantula*, H. J. Hansen, Cirolanidæ, &c. p. 364, pl. v. figs. 2-2t.

Process from clypeus large, seen vertically from below covering at least the major part of the area between the mandibular palps.

Antennulæ.—Male: Peduncle strongly thickened, much thicker than in the female, but third joint shorter than in that sex, about as long as second joint; flagellum reaches the anterior lateral angle of thorax, its first joint is thickened, especially towards the base, compressed and furnished with an immense number of very long sensory hairs, while the four other joints are very short, and their combined length is more than three times shorter than first joint; one of the terminal setæ is somewhat longer than these four distal joints together. Female: of normal size; third joint of the peduncle a little longer than the second; flagellum reaches to the anterior lateral angle of thorax, its first joint is somewhat shorter than in the male, less compressed, scarcely thickened, with a moderate number of shorter sensory hairs, more than three times longer than the remaining joints together; terminal setæ short.

Peduncle of antennæ with the penultimate joint conspicuously more than half as long as the terminal one.

Epimera of second to fourth thoracic segment produced in quite rudimentary or very small processes; epimera of fifth segment with the process a little longer, those of the two posterior segments produced into moderately short processes nearly equal in size.

Seventh thoracic legs slender; fourth joint considerably longer than broad and a little shorter than the fifth; fourth and fifth joints without spines or setæ on the lower surface, the margins themselves excepted.

Last abdominal segment has on the upper surface a deep transversely oval impression at most one-third as broad as the segment, and besides sometimes at each end of this central excavation, and touching it, a feeble sublateral impression. Hind margin nearly straight or slightly convex, at least half as long as the breadth of the segment, without movable spines, but at each end limited by a very conspicuous triangular tooth.

Uropoda proportionately considerably larger in the male than in the female, but their natatory setæ are longer in the female than in the male. The endopod, when parallel with the axis of the animal, reaches a little beyond the abdomen.

Length of the male 5-7 mm., of the female 7-8.5 mm.

*Occurrence.*—I have seen specimens from lat.  $56^{\circ}$  N., long.  $18^{\circ}$  W., and off South-western Iceland, lat.  $63^{\circ} 21'$  N., long.  $25^{\circ} 21'$  W.; furthermore from the sea from these two places to the most northern part of Scotland, and especially to and around the Færoe Islands: in this area it has been captured twelve times, always distant from the coast, and probably always pelagic, though in a few instances it was taken in the dredge or the trawl. According to A. O. Walker (Trans. Liverp. Biol. Soc. xii. p. 165) it has been secured on the west coast of Ireland, at Outer Harbour, Killiebegg, Co. Donegal, 14-16 fathoms. In material received from Canon Norman I found a single specimen from the 'Porcupine' Expedition: St. 29, off Cadiz, Spain, 227 fathoms. Dollfus records it from the Azores: "Au large de Porta Delgada, île San Miquel, . . . surface."

*Remarks.*—The species is easily distinguished from all other European forms by having the transverse hind margin of the abdomen long, without movable spines, but limited at each end by a conspicuous triangular tooth; antennulæ, epimera, &c. afford

other good characters. When, in 1890, I established this species as *E. elegantula*, I wrote that until further evidence was procured I thought it better not to regard my species as identical with *E. Grimaldii*, Dollf., from the Azores; the latter form being very imperfectly characterized, and the flagellum of its antennulæ described as one-jointed. The examination of typical specimens of *E. Grimaldii*, Dollf., kindly forwarded me by Mr. Dollfus, showed that this species is identical with mine; the name given by me must therefore be cancelled.

3. *EURYDICE TRUNCATA*, Norm. (1868). (Pl. 34. figs. 2 a-2 b.)

Male and female.

1868. *Cirolana truncata*, A. M. Norman, Ann. Mag. Nat. Hist. ser. 4, vol. ii. p. 421, pl. xxiii. figs. 12-15 (female).

1890. *Eurydice truncata*, H. J. Hansen, Cirolanidæ, &c. p. 375. [Without description, but giving occurrences and the literature concerned.]

1895. *Eurydice truncata*, H. J. Hansen, Isopoden, Cumaceen, und Stomapoden der Plankton-Expedition, p. 13, pl. i. figs. 5-5 h (male).

Process of clypeus small, seen vertically from below covering a minute portion of the area between the mandibular palps.

Antennulæ.—Male: The antennulæ reach behind the anterior lateral angle of second thoracic segment. Peduncle considerably thickened; third joint shorter than the second. Flagellum rather robust at the base, otherwise slender, very elongate; first joint somewhat shorter than the combined length of the four others, with a large number of moderately long sensory hairs; second joint much shorter than the third, which is a little longer than the fourth; the minute terminal joint with a few setæ, one of which is robust and exceedingly long, almost longer than the whole flagellum.—Female (Pl. 34. fig. 2 b): The antennulæ reach to the anterior lateral angle of thorax. Peduncle moderately slender; third joint considerably shorter than the second. Flagellum slender; first joint only slightly longer than the four others together, with a moderate number of sensory hairs; second joint conspicuously shorter than third or fourth; terminal minute joint with some setæ, the longest of which is slightly longer than the three distal joints combined.

Peduncle of antennæ with the penultimate joint conspicuously more than half as long as the terminal one.

Epimera of second, third, and fourth thoracic segments scarcely or not at all produced behind; epimera of fifth segment produced

into a rather small, yet very conspicuous process; epimera of sixth segment produced into rather long processes, much longer than those of seventh epimera.

Seventh thoracic legs slender; fourth joint much longer than broad, a little shorter than the fifth; fourth joint with one or two spines; fifth joint with one spine on the lower surface rather removed from the inner margin.

Last abdominal segment has on its upper surface a transverse broad impression, often connected at each end with a faint transverse sublateral impression. Posterior margin about one-third as long as the breadth of the segment, distinctly convex, finely serrate, without movable spines, at each end with a conspicuous or even rather large triangular tooth, and at the outer base of this tooth another very small tooth or minute projecting angle.

Length of an adult male from Naples 4.2 mm.; of a female without marsupium from Shetland 7.2 mm.

*Occurrence*.—Norman's type specimen was dredged by him in St. Magnus Bay, Shetland, 40–60 fathoms (a specimen from this locality has been examined by me, from which my two figures are taken); many years after it was obtained in lat.  $59^{\circ} 28' N.$ , long.  $6^{\circ} 33' W.$ , 53 fathoms (Norman). In material from Mr. Dollfus I found two specimens captured near Concarneau, south-western coast of Brittany, 50–60 m.; one specimen near Belle-Isle; numerous not half-grown specimens from La Banche, France, 17 m., and three specimens from the coast of Morocco, 130 m. The male described by me in 1895 was secured at Naples. Lo Bianco (Mitt. Zool. Stat. Neap. xxiii. p. 196) records two specimens obtained by Mr. F. A. Krupp in the Mediterranean, in the open sea, at two stations some miles from Capri. The species is probably always pelagic.

*Remarks*.—Adult specimens of this species are easily distinguished from all other forms by the flagellum of the antennulæ and by the hind margin of abdomen, where the existence of a minute tooth or sharp angle outside a rather large tooth is very characteristic. The epimera are very similar to those of *E. pulchra*, but in the latter species the fifth epimera are without real processes. In half-grown or still smaller specimens the structure described of the angles at the posterior margin of abdomen is often obscure, but they can be recognized with certainty by the small process from clypeus, by antennulæ and epimera. At least

such small specimens have probably sometimes been referred to *E. pulchra* by zoologists.

4. *EURYDICE PULCHRA*, *Leach* (1815). (Pl. 34. figs. 3 a-3 c ; Pl. 35. fig. 1 a.)

Male and female.

1890. *Eurydice pulchra*, H. J. Hansen, Cirolanidæ, &c. p. 370, pl. vi. figs. 3-3 i [with synonymy, &c.]

1897. *Eurydice pulchra*, G. O. Sars, Account Crust. Norw. vol. ii. p. 73, pl. xxx. fig. 2.

Process of clypeus large, seen vertically from below covering the whole area between the mandibular palps.

Antennulæ rather similar in both sexes, reaching to the anterior lateral angle of thorax. Peduncle moderately thick, its third joint a little longer than the second. Flagellum in the male with the first joint thick, considerably longer than the third joint of the peduncle, scarcely twice as long as the distal joints of flagellum combined and furnished with a large number of rather short sensory hairs; in the female the first joint of flagellum is shorter and more slender, yet somewhat longer than third joint of the peduncle; in both sexes the second joint is about as long as thick, longer than the third; terminal setæ very short.

Peduncle of antennæ with the penultimate joint at most half as long as the terminal one.

Epimera of second to fifth thoracic segments not produced into processes; those of sixth segment with a moderately long process; epimera of seventh segment with rather small processes.

Seventh thoracic legs broader than in any other species. Fourth joint only a little longer than broad and somewhat shorter than the fifth; both these joints on the lower surface with some spines rather removed from the inner margin and some spines rather near the outer margin.

Last abdominal segment has on its upper surface a deep transverse, but yet not broad impression, the anterior margin of which is considerably curved, and besides a pair of sublateral, conspicuous, irregular impressions not connected with the central one. Posterior margin at most a little more than one-third as long as the breadth of the segment, rather convex, finely serrate, without any distinct tooth at the ends, but armed with two pairs of movable spines; the spines on each half somewhat distant from each other.



Length of an adult male 4.2 mm.; of large females without marsupium 7 mm.

*Occurrence.*—From various localities in Denmark I have seen a large number of specimens; it seems to be rather common in Kattegat and around our Islands between Jutland and Sweden; it is mentioned in the literature from the Bay of Kiel and from Travemünde. The animal figured by Sars certainly belongs to this species, and according to him it is met with in Christianiafjord and on the southern and western coasts of Norway northward at least to Trondhjem. Norman mentions it from St. Magnus Bay, Shetland, and Th. Scott from Lerwick Bay, Shetland, which in all probability are correct statements. Material from Mr. Dollfus contained specimens from the Firth of Clyde, western coast of Scotland; from five localities on the northern coast of France, viz. Crotoy between Boulogne and Dieppe, Trouville and Villers not far from Le Havre, Carteret on the western coast of Normandy, and St. Lunaire near St. Malo (at the last-named place a specimen was taken in a puddle on the beach); finally, from two localities at the western coast of France, viz. Belle-Isle, off the southern coast of Brittany, and Pontailac, near Royan, Charente-Inférieure. In 1890 I put together several other statements found in the literature (and biological notes) on its occurrence in localities situated within the area circumscribed by the above-named places, for instance, at Portel (rather near Boulogne), on the coasts of Belgium, Holland, and Great Britain; but it is not improbable that the specimens observed at some of the places mentioned by earlier authors belonged to other species, especially *E. affinis*, n. sp., or *E. inermis*; on the other hand, it occurs, in all probability, on all the coasts in question. Finally, P. Gourret (Ann. Mus. Hist. Nat. Mars., Zool. iv. fasc. II. p. 13) speaks of its occurrence at Marseilles; according to 'Zool. Record' for 1896, Sowinsky has stated that it is found in the Black Sea; and Lo Bianco mentions eight specimens from seven localities, partly off Capri and partly from the sea between Monaco and the northern end of Corsica. I am, however, inclined to think that all these statements are erroneous\*.

\* Gourret's papers on Crustacea are, according to statements by other authors and my own judgment, far from trustworthy. It is easily seen from Lo Bianco's paper that Gourret was not acquainted with several carcinological papers of importance, and some of his determinations are either not correct or really misleading. He undertook the naming of species of nearly all groups of marine animals, but that task cannot be done well by any living zoologist.

*Remarks.*—*E. pulchra* is easily distinguished from all other European species—*E. affinis* to a certain degree excepted—by the shape and armature of the posterior margin of the abdomen; from *E. affinis* it is easily separated by having moderately large processes on the epimera of the sixth segment. More than 120 years ago Slabber described and figured a *Eurydice*, “Agaat-Pissebet (*Oniscus Achatus*),” which may be this species, and therefore some few authors call it *E. achata*, Slabber, while most writers adopt the denomination given by Leach in 1815, *E. pulchra*. It is rather probable that both Slabber and Leach examined the species described as *E. pulchra* in the present paper; but unfortunately I am not able to prove it in either case, as the distribution of *E. affinis*, n. sp., is too imperfectly known, and the old descriptions are insufficient for deciding the question; Slabber’s original paper—the Dutch edition—is, besides, unknown to me. For these reasons and in order to preserve, if possible, the name used in almost the whole literature, I adopt the denomination *E. pulchra*, Leach.

5. EURYDICE AFFINIS, n. sp. (Pl. 35. figs. 2 a–2 k.)

Male and (?) adult female.

Process of clypeus of considerable size, seen vertically from below covering the major portion of the area between the mandibular palps.

Antennulæ reach scarcely to the anterior lateral angle of thorax.—Male: Peduncle with the second joint somewhat thickened, third considerably thickened, but scarcely longer than the second. Flagellum clumsy; first joint thick, somewhat elongate, as long as the combined length of the two distal joints of the peduncle and more than twice as long as that of the four distal joints of flagellum, furnished with numerous rather short sensory hairs; second joint thicker than long and longer than the third; terminal setæ short.—Female: Peduncle of normal moderate thickness; its third joint much longer than the second, and much longer but considerably more slender than in the male. Flagellum rather slender; first joint considerably shorter and much more slender than in the male, not longer than the third joint of the peduncle, and less than twice as long as the following joints combined, furnished with rather few sensory hairs; second joint longer than thick.

Peduncle of antennæ with the penultimate joint about half as long as the terminal one.

Epimera of the thoracic segments with the posterior angle sharp, at least on the posterior pairs, but none of them produced into processes.

Seventh thoracic legs rather broad; fourth joint somewhat longer than broad and rather shorter than the fifth; both these joints on the lower surface with in all a few strong spines at some distance from the inner margin, and no spines but a number of setæ near the outer margin.

Last abdominal segment has on its upper surface a moderately deep and rather broad transverse impression, the anterior margin of which is a little convex, while its ends are distinctly connected with good-sized sublateral impressions; from the inner end of each of these a longitudinal impression proceeds often forwards. Hind margin slightly longer than one-third of the breadth of the segment, at each end limited by a distinct but short tooth; the margin is somewhat convex, not distinctly serrate, armed with two pairs of movable spines, those on each half very distant from each other.

Uropoda rather large; endopod, when directed parallel with the axis of the animal, reaches considerably beyond the hind margin of the abdomen.

Length of an adult male 4 mm.; of a female without marsupium 4.2 mm.

*Occurrence*.—Of this species I have seen nearly 130 specimens from six localities on the northern and western coasts of France, viz., Carteret, on the western coast of Normandy; St. Lunaire, near St. Malo (88 specimens); Belle-Isle, off the south-western coast of Brittany; Pontillac near Royan, Charente-Inférieure; Arcachon; finally, Hendaye, near the Spanish frontier. One specimen was labelled 35–60 m.; the numerous specimens from St. Lunaire and a specimen from Hendaye were taken swimming in puddles on the beach.

*Remarks*.—The species is easily distinguished from all other forms, *E. inermis* excepted, by the absence of processes on all thoracic epimera; from the last-named species it is easily separated by the length, shape, and armature of the posterior margin of abdomen. It is closely allied to *E. pulchra*, and has probably sometimes been referred to that species.—Fig. 2 *k* (Pl. 35) shows the “appendix masculina” of second pleopod; it is comparatively broader than in *E. pulchra*, but its terminal portion is shaped nearly as in that species.

6. EURYDICE INERMIS, *H. J. Hansen*. (Pl. 35. figs. 3 a-3 c.)

Male and female.

1890. *Eurydice inermis*, H. J. Hansen, Cirolanidæ, &c. p. 366, pl. v. figs. 3-3 f (female).

Process of clypeus very small, seen vertically from below covering a minute portion of the area between the mandibular palps.

Antennulæ.—Male: The antennulæ reach to the anterior lateral angle of thorax. Peduncle much thickened, especially its two proximal joints. Flagellum moderately robust at the base, otherwise slender; first joint somewhat compressed, a little longer than the combined length of the two distal joints of the peduncle and conspicuously more than twice as long as that of the other joints of flagellum, furnished with a good number of moderately long sensory hairs; second joint twice as long as the third; fourth joint terminates in some setæ, one of which is robust and even somewhat longer than the whole flagellum.—Female: Rather slender, especially flagellum which does not reach the front lateral angle of thorax; flagellum otherwise nearly as in the male, but with rather few sensory hairs and the terminal setæ short.

Peduncle of antennæ with the penultimate joint conspicuously more than half as long as the terminal one.

Epimera of all thoracic segments with their posterior angles subsimilar, at most produced into exceedingly small processes.

Seventh thoracic legs rather slender; fourth joint somewhat longer than broad and somewhat shorter than fifth; both these joints on the lower surface without spines and almost without setæ, those of the margins excepted.

Last abdominal segment has on its upper surface a transverse broad impression, often connected with vestiges of transverse sublateral impressions. Posterior margin very short, less than one-fourth as long as the breadth of the segment, slightly convex, with about nine very distinct saw-teeth, the most lateral pair a little longer than the others; no marginal spines.

Uropoda unusually small in both sexes; endopod, when directed parallel with the axis of the animal, far from reaching to the posterior margin of abdomen.

Length of an adult male 5.6 mm.; of a female with marsupium 5.2 mm.

*Occurrence*.—This species was established on an adult female and two immature specimens from Cape Lizard, southern end of

Cornwall. Canon A. M. Norman informs me in a letter that in 1903 he took the species at Plymouth. A few years ago the Copenhagen Museum received the adult male described and some small specimens captured at Dennis Head, the most northern point of the Orkney Islands (Mag. sc. C. H. Ostenfeld). In material from Mr. Dollfus I found a single specimen from La Banche, near Le Croisic, on west coast of France.

*Remarks.*—This small species is easily distinguished from all other European forms, *E. affinis* excepted, by having obsolete or quite minute processes on the epimera of the sixth thoracic segment; it is separated from all species by the very short, serrate posterior margin of abdomen, without movable spines. Figs. 3*b* and 3*c* show the second male pleopod and its “appendix,” for comparison with the same parts of other species figured in my earlier papers.

*Species referred with doubt to Eurydice.*

*E. pontica*, Czerniavsky: “Materialia ad Zoographiam Ponticam comparatam,” in ‘Transact. of the First Meeting of Russian Naturalists in St. Petersburg,’ 1868, 4to (written in Russian), p. 81, pl. vi. figs. 4–6. I have not seen the paper, but quote it from E. v. Martens in the ‘Zoological Record’ for 1870. Czerniavsky describes the animal as *Helleria pontica*; it is from the Black Sea.

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## EXPLANATION OF THE PLATES.

## PLATE 33.

Fig. 1. *Cirolana gallica*, n. sp.

- Fig. 1 *a*. Head, thorax, and proximal part of abdomen, from the right side;  
 $\times 4$ .  
 1 *b*. Left antenna, from below;  $\times 15/2$ .  
 1 *c*. Seventh left thoracic leg, from below;  $\times 15/2$ .  
 1 *d*. Last abdominal segment and uropoda, from above;  $\times 7$ .

Fig. 2. *Cirolana Schmidtii*, n. sp.

Immature female.

- Fig. 2 *a*. Lateral part of thorax, from the right side; scarcely  $\times 8$ .  
 2 *b*. Seventh left thoracic leg, from below;  $\times 13$ .  
 2 *c*. Right uropod, from above;  $\times 13$ .

Fig. 3. *Cirolana Cranchii*, Leach.

Adult male.

- Fig. 3 *a*. Right uropod, from above;  $\times 8$ .

Fig. 4. *Cirolana Hanseni*, Bonnier.

Immature specimen.

- Fig. 4 *a*. Animal, from above;  $\times 11$ .  
 4 *b*. Right part of thorax and of proximal part of abdomen, from the side;  
 $\times 21$ .  
 4 *c*. Second left thoracic leg, from below (from behind);  $\times 36$ .  
 4 *d*. Fifth left thoracic leg, from below (from in front);  $\times 36$ .

## PLATE 34.

Fig. 1. *Cirolana Hanseni*, Bonnier; continued.

- Fig. 1 *a*. Head with proximal part of antennulæ and antennæ, from above;  
 $\times 24$ .  
 1 *b*. Anterior part of the head, from below, showing antennulæ, peduncle,  
 and proximal part of flagellum of antennæ, eyes, frontal plate,  
 clypeus, labrum, and anterior part of mandibles with their palps;  
 $\times 35$ .  
 1 *c*. Left mandible, from below;  $\times 50$ .  
 1 *d*. Distal part of left mandible, from above;  $\times 83$ .  
 1 *e*. Left maxillula, from below;  $\times 50$ .  
 1 *f*. Left maxilla, from below;  $\times 50$ .  
 1 *g*. Left maxilliped, from below;  $\times 50$ .  
 1 *h*. Five proximal joints of left maxilliped, from above, showing the lobe  
 from second joint with its single hook and some setæ;  $\times 50$ .  
 1 *i*. Seventh left thoracic leg, from below (from in front);  $\times 36$ .  
 1 *k*. The two posterior abdominal segments with the uropoda, from above;  
 $\times 22$ .

Fig. 2. *Eurydice truncata*, Norman.

Female without marsupium.

Fig. 2 a. Head, thorax, and major portion of abdomen, from the right side;  
× 8.

2 b. Left antennula, from below; × 46.

Fig. 3. *Eurydice pulchra*, Leach.

Large female without marsupium.

Fig. 3 a. Right part of thorax and major portion of abdomen, from the side;  
× 10.

3 b. Last abdominal segment with uropoda, from above; × 21.

3 c. Posterior margin of the segment shown in fig. 3 b; × 43. Setæ  
omitted.

## PLATE 35.

Fig. 1. *Eurydice pulchra*, Leach; continued.

Fig. 1 a. Left antennula of a large female, from below; × 43.

Fig. 2. *Eurydice affinis*, n. sp.

Adult male, and female without marsupium.

Fig. 2 a. Right part of thorax and five anterior abdominal segments of the  
male, from the side; × 20.

2 b. Left antennula of the male, from below; × 59.

2 c. Left antennula of the female, from below; × 59.

2 d. Second left thoracic leg of the male, from below (from behind);  
× 30.

2 e. Fifth left thoracic leg of the male, from below (from in front); × 30.

2 f. Seventh left thoracic leg of the male, from below (from in front);  
× 30.2 g. Last abdominal segment with the uropoda of the female, from above;  
× 31.2 h. Posterior margin of the segment shown in fig. 2 g; × 60. The four  
movable spines are shown, but of the setæ only the proximal part  
has been drawn.

2 i. Posterior margin of last abdominal segment of the male; × 60.

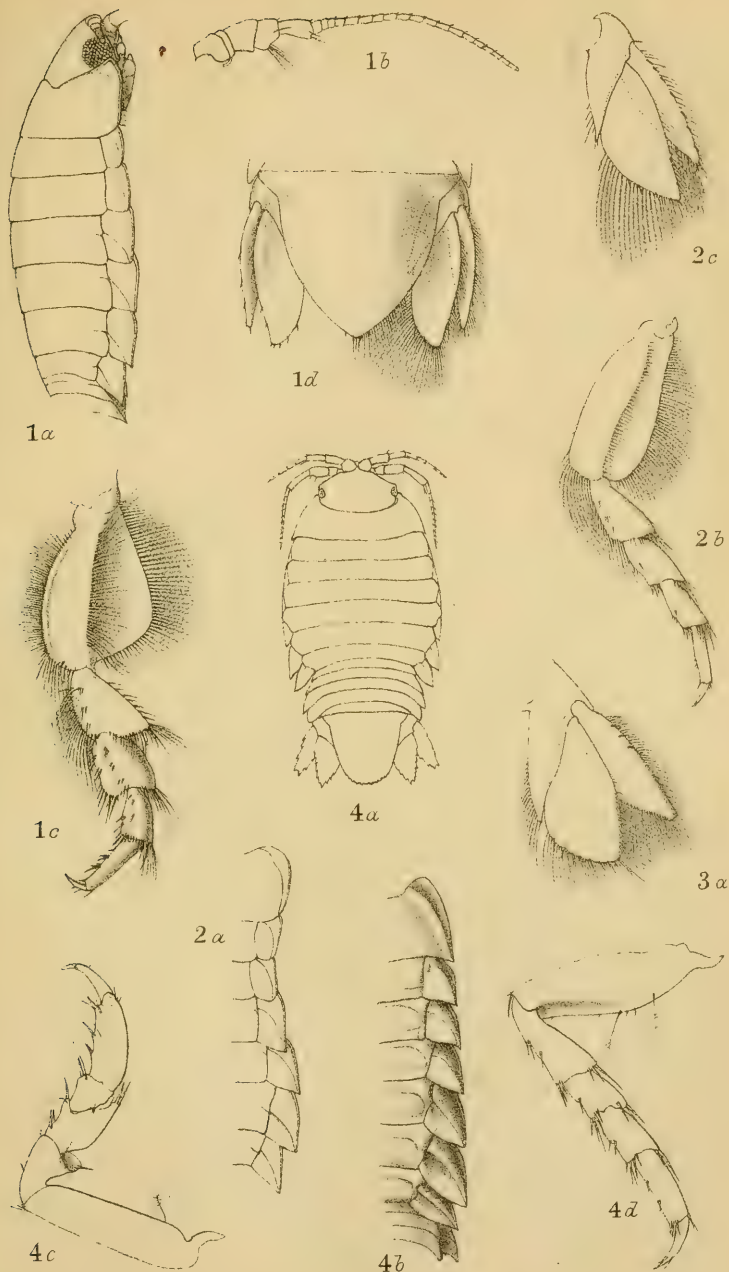
2 k. "Appendix masculina" of second left male pleopod, from below;  
× 77.Fig. 3. *Eurydice inermis*, H. J. Hansen.

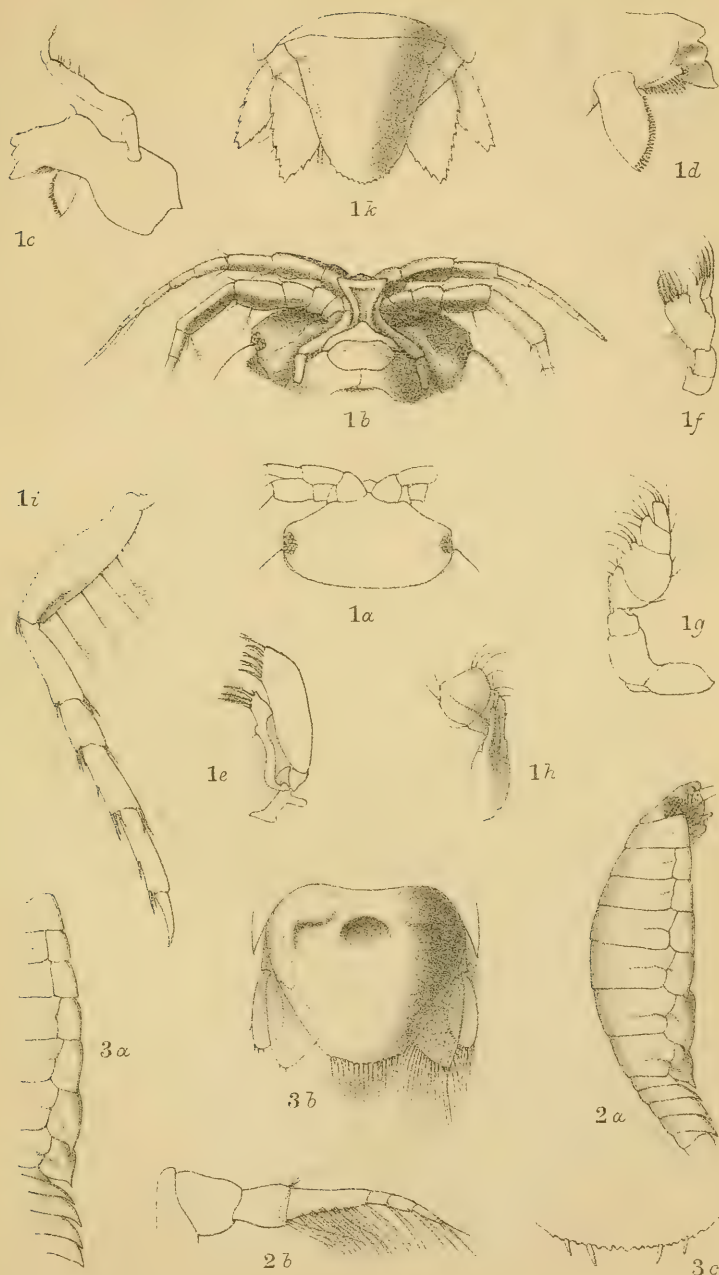
Adult male.

Fig. 3 a. Left antennula, from below; × 52.

3 b. Second left pleopod, from below; × 29.

3 c. "Appendix masculina" of second left pleopod, from below; × 40.





H.J. Hansen, del. J.T. Rennie Reid, Lich. Edinb.

1. CIROLANA HANSENI, Bonn. 2. EURYDICE TRUNCATA, Norm.  
3. E. PULCHRA, Leach.



